The causes of blindness in Children

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THE CAUSES OF BLINDNESS IN CHILDREN

THEIR RELATION TO PREVENTIVE OPHTHALMOLOGY

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A study of 2,702 children in schools for the blind in the school year 1933-1934 disclosed certain facts concerning the causes of blindness and the possibilities for preventive work that made it seem desirable to direct the attention of ophthalmologists to the eye conditions incident in the younger age groups. This paper is presented in the hope that the dissemination of the information secured may make it possible to obtain more reliable data which will stimulate medical research and programs for the prevention of blindness.

Reliable information on causes of blindness has been lacking. Even when detailed studies have been made they have been limited to a comparatively small number of patients or to a restricted geographic area, so that they could not be considered representative; and because the methods and classifications used lacked uniformity, the results of these studies could neither be compared nor totaled scientifically.

Read before the Section on Ophthalmology at the Eighty-Sixth Annual Session of the American Medical Association, Atlantic City, N. J., June 13, 1935.

The members of the Committee on Statistics of the Blind acknowledge with grateful appreciation the valuable assistance they have received from ophthalmologists throughout the country, both in constructive criticism during the development of these classifications and in cooperation during the studies made in the schools for the blind.

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Recognizing this difficulty, the Committee on Statistics of the Blind [1] set up a standard classification of causes of blindness [2] which could be applied to any group and which would make possible uniform statistics for the entire country. This classification was prepared with the advice and cooperation of a number of ophthalmologists, and in 1934 the Section on Ophthalmology of the American Medical Association designated a committee (under the chairmanship of Dr. T. B. Holloway) to serve in an advisory capacity to the Committee on Statistics of the Blind.

METHOD OF STUDY

In the academic year 1933-1934, at the invitation of a group of schools for the blind,[3] the Committee on

1. The Committee on Statistics of the Blind, sponsored jointly by the American Foundation for the Blind and the National Society for the Prevention of Blindness, was appointed in 1930 to act as a coordinating body, whose chief functions are to develop standard methods for recording and summarizing information adaptable to statistical treatment and to act as a central agency for the collection, analysis and distribution of these data. The members of the committee are Conrad Berens, M.D., ophthalmic surgeon, New York Eye and Ear Infirmary; Lewis H. Carris, managing director, National Society for the Prevention of Blindness; Ralph C. Hurlin, Ph.D., chairman, director, Department of Statistics, Russell Sage Foundation; Robert B. Irwin, executive director, American Foundation for the Blind; C. Edith Kerby, statistician, National Society for the Prevention of Blindness; Evelyn C. McKay, research agent, American Foundation for the Blind; Bennet Mead, statistician, United States Department of Justice; B. Franklin Royer, M.D.; Stetson K. Ryan, executive secretary, Connecticut Board of Education of the Blind

2. The standard blanks and classifications mentioned in this paper may be obtained without charge from the secretary of the Committee on Statistics of the Blind, 15 West Sixteenth Street, New York.

3. List of schools and classes for the blind included in study on causes of blindness for the school year 1933-1934:

Name of School	Examining Ophthalmologist
Alabama School for the Blind	Dr. Joseph Brown (OALR)
Alabama School for the Negro Deaf and Blind	Dr. Joseph Brown (OALR)
Illinois School for the Blind	Dr. A. L. Adams (Oph)
Louisiana State School for the Blind, white	Dr. Rufus Jackson (OALR)
Maryland School for the Blind	Dr. L. J. Goldbach (Oph)
Maryland School for the Blind (Department Colored Blind and Deaf)	Dr. L. J. Goldbach (Oph)
Perkins Institution and Massachusetts School for the Blind	Dr. Harold B. Chandler (Oph) Dr. Trygve Gundersen (Oph)
Minnesota School for the Blind	Dr. Douglas Wood (OALR) Dr. J. H. Gammell (OALR)
Mississippi School for the Blind, white	Dr. M. L. Batson (Oph)
Missouri School for the Blind	Dr. Harvey D. Lamb (Oph)
New York State School for the Blind	Dr. H. H. Glosser (Oph)
New York Institute for the Education of the Blind	Dr. Bernard Samuels (Oph)
North Carolina State School for the Blind and Deaf	Dr. V. M. Hicks (Oph)
North Carolina State School for the Blind and Deaf, Colored Dept.	Dr. V. M. Hicks (Oph)
Ohio State School for the Blind	Dr. Albert D. Frost (Oph)
Pennsylvania Institution for the Instruction of the Blind	Dr. Thomas B. Holloway (Oph)
Tennessee School for the Blind, white	Dr. Bruce P'Pool (OALR)
Wisconsin School for the Blind	Dr. Benjamin I. Brindley (OALR)
Chicago Day School Classes for the Blind	.....
Cleveland Day School Classes for the Blind	Dr. S. H. Monson (OALR)

Statistics of the Blind made a study of causes of blindness among pupils in these schools. Eighteen residential schools and the public school braille classes of two cities were included, a total of 2,702 children. Since this number represents nearly half the children registered in schools for the blind, and since the institutions studied were widely scattered geographically, this group may be considered representative of the country as a whole.

The examining ophthalmologist was asked to record his observations on a special report form (fig. 1). This form does not require a detailed record of a complete ophthalmologic examination but only the minimum of medical data, in summary form, that is considered essential for the intelligent solution of problems relating to the child's education, vocational guidance and medical care, as well as for statistical purposes. Especial attention is called to the heading "diagnosis," with its three subdivisions (1) eye condition primarily responsible for blindness, (2) secondary conditions, if any, and (3) etiologic factor responsible for the primary eye condition.

THE IMPORTANCE OF ETIOLOGY

Etiology is stressed as a separate question because experience has shown that the ophthalmologist tends to record his diagnosis in terms of the nature and location of the eye lesion. This is true even when he has diagnosed the underlying etiologic factor and has prescribed treatment for it.

From the point of view of social programs, etiologic information is of paramount importance, particularly to those social workers interested in the prevention of blindness. They can grasp its significance more readily and use it in the education of the public. Gradually the majority of ophthalmologists are also placing more emphasis on this part of the diagnosis.

Our experience in obtaining etiologic data on 2,702 children has convinced us that this is not a simple procedure for the ophthalmologist. However, since the summarized data can be no better than the source material from which they are obtained, examining ophthalmologists are urged to give special attention to etiologic information. Since the school ophthalmologist must make his examinations at a time far removed

from the occurrence of blindness, all known facts about the case should be assembled for his consideration. The assistance of a public health nurse or medical social worker in making necessary investigations would be valuable. A complete summary of information concerning each case should be placed on file either in the state commission for the blind or (if there is no state commission) in the department of health. If this were done at the time of onset of blindness, the reports would serve also as an indication of the trend of blindness. At the present time it is impossible to determine whether blindness is increasing or decreasing.

Age Group.—The age group studied (table 1) is comparable to that usually found in elementary and secondary schools, except that there may be a larger

RE-EXAMINATIONS

Date	Best Corrected Vision		Changes in Eye Condition	Recommendations (Further examination or treatment—Specify)	Physician's Signature
	Right Eye	Left Eye			

Fig. 2.—Report form for reexaminations.

percentage of pupils 20 years of age and over. Since this study is confined to children, only the conditions that occur in this age group will be found. However, in presenting statistics on the causes of blindness, the committee's complete scheme of classification has been used in order to make it available to those who are not familiar with it.

Classification by Amount of Vision Remaining.—Classification by the amount of vision remaining (table 2) is of special interest to ophthalmologists. Cases were grouped according to visual acuity in the better eye (with correction, when lenses were worn).

Obviously, the nature of the statistical observations on the causes of blindness is greatly affected by the individual definitions of the term "blindness," and at the present time no uniform definition of "blindness" could be found on which ophthalmologists and workers for the blind throughout the country would agree. Therefore "the blind" were divided into groups on the basis of visual acuity, those differences in degrees of vision being selected which seem to determine the type of work the individual is able to do. The five groupings range from 20/200 (Snellen) to "total blindness or light perception only."

The outstanding feature of this study is the fact that, even though the upper limit of the original classification —group 5, "borderline cases"—was set at 20/200, 12.6 per cent of pupils in these schools had better vision. Approximately 4 per cent of the total number of pupils had better vision than 20/70, which is usually designated as the maximum vision for sight-saving class pupils. We realize that there are many eye conditions in which central visual acuity is not a true measure of the extent of the visual handicap. This explanation, however, does not account for all cases which present only moderate or slight visual handicap. In fact, many of these children should not attend a school for the blind. Educators are of the opinion that the partially seeing group should not be institutionalized unless their educational needs can be met in no other way. The schools that are giving sight-saving class instruction (rather than braille or tactual training) to pupils with moderate visual handicap have taken a step in the right direction. However, among the eighteen institutions studied there are only two schools that have sight-saving classes.

The presence in institutions for the blind of large numbers of children having some vision suggests that ophthalmologists should be consulted in adjusting the environmental conditions and teaching methods to safeguard the remaining vision. The problem of accurate classification by amount of vision remaining is complicated by the mental condition of many of these children. Holloway [4] reports that 43.7 per cent of the pupils at the Overbrook School for the Blind fall into the group of the dull, backward or feebleminded.

4. Holloway, T. B.: The New Statistics on Causes of Blindness Among Children, Sight-Saving Rev. **5**: 13 (March) 1935.

CLASSIFICATION BY CAUSE [5]

Data on the causes of blindness are presented according to an etiologic and a topographic classification. The plan is similar to that of the Standard Classified Nomenclature of Disease,[6] but the lists of the Committee on Statistics of the Blind include only conditions that may lead to blindness.

Etiologic Classification.—In this classification (table 3) the causes are grouped under six main headings: (1) infectious diseases, (2) traumatic and chemical

TABLE 1.—*Age Distribution*

Present Age (as of 6/1/34)	Total Pupils	Per Cent of Total
All ages	2,702	100.0
Under 5 years	3	0.1
5 to 9 years	356	13.2
10 to 14 years	954	35.3
15 to 19 years	934	34.6
20 years and over	394	14.6
Age not reported	61	2.2

TABLE 2.—*Distribution by Amount of Vision Remaining*

	Number	Per Cent
Total 20 schools and classes reporting	2,702	100.0
Group 1 (total blindness, or light perception only, [less than 2/200])	1,003	37.1
Group 2 (2/200 but not 5/200)	430	15.9
Group 3 (5/200 but not 10/200)	366	13.6
Group 4 (10/200 but not 20/200)	258	9.6
Group 5 (20/200) "borderline" cases	226	8.3
Better than 20/200 through 20/70	240	8.9
Better than 20/70	100	3.7
Not reporting vision remaining	79	2.9

injuries, (3) toxic poisoning, (4) neoplasms, (5) noninfectious systemic diseases, and (6) congenital and hereditary. Under each heading the individual items represent the causes that occur most frequently, but there are two general items to cover other specified cases of the same nature and those cases belonging in the group but not specified. The inclusion of the latter type of item under each heading makes it possible to reduce the miscellaneous "unknown" group ("etiology not specified") to a minimum.

5. The relative proportions of the various causes here discussed are typical only of the younger age groups.

6. A Standard Classified Nomenclature of Disease, Compiled by the National Conference on Nomenclature of Disease, New York, the Commonwealth Fund, 1933.

TABLE 3.—*Causes of Blindness: Classification by Etiologic Cause*

Cause of Blindness	Number	Per Cent
Infectious diseases	**772**	**28.6**
Diphtheria	3	0.1
Gonorrhea (excluding ophthalmia neonatorum)	6	0.2
Measles	24	0.9
Meningitis	55	2.0
Ophthalmia neonatorum		
Gonorrheal	82	3.0
Other types, specified	—	—
Not specified	208	7.7
Scarlet fever	6	0.2
Septicemia	16	0.6
Smallpox	3	0.1
Syphilis		
Prenatal	126	4.7
Acquired	—	—
Origin not specified	15	0.6
Trachoma	13	0.5
Tuberculosis	13	0.5
Typhoid	1	0.1
Other infections, specified	30	1.1
Infections, not specified	171	6.3
Traumatic and chemical injuries	**211**	**7.8**
Nonindustrial injuries		
War	—	—
Explosives		
Fireworks	4	0.2
Firearms	19	0.7
Other explosives, specified	28	1.0
Explosives, not specified	—	—
Play or sport	68	2.5
Household activities	4	0.2
Street and traffic accidents	10	0.3
Injuries incidental to surgery	1	0.05
Birth injuries	4	0.2
Other nonindustrial injuries, specified	30	1.1
Nonindustrial injuries, not specified	22	0.8
Industrial injuries and diseases		
Trauma (including burns) specified	1	0.05
Industrial disease (including poison)	—	—
Industrial injury, not specified	—	—
Injuries, not specified	20	0.7
Toxic poisoning (excluding industrial)	**2**	**0.1**
Tobacco	—	—
Alcohol (ethyl, grain)	—	—
Alcohol (methyl, wood, denatured)	1	0.05
Other toxic poison, not specified	1	0.05
Neoplasms	**58**	**2.2**
Noninfectious systemic diseases	**33**	**1.2**
Anemia and other blood diseases	—	—
Diabetes	—	—
Nephritis and other kidney diseases	1	0.1
Vascular diseases	—	—
Noninfectious diseases, central nervous system	14	0.5
Diseases of pregnancy and childbirth	—	—
Other systemic diseases, specified	13	0.4
Systemic diseases, not specified	5	0.2
Congenital and hereditary	**1,382**	**51.1**
Prenatal	1,067	39.5
Hereditary and familial	315	11.6
Etiology not specified	**244**	**9.0**
Unknown to science	4	0.1
Undetermined by physician	186	6.9
Not specified	54	2.0
Total—All causes	**2,702**	**100.0**

The congenital and hereditary group accounts for more than half the cases of blindness among children (51.1 per cent). This group is subdivided into two parts. In one part are the hereditary and familial cases (11.6 per cent) in which have been included all those specified as hereditary by the examiner and also those specified as "congenital" but suspected of being hereditary because of the presence in the same school of sisters or brothers with the same eye condition. It seems quite probable that, if family histories of all cases in the congenital group could have been studied, the percentage transferred to "hereditary" would be markedly increased. The "prenatal" cases should also be investigated for evidences of underlying etiologic factors. Routine Wassermann tests, which are not now required in many schools for the blind, would aid the ophthalmologist in making diagnoses of prenatal syphilis and would undoubtedly result in classifying many more cases under the "infectious disease" heading.

The number classified as "congenital and hereditary" indicates that these are the cases most in need of attention from the standpoint of prevention. A more intensive study of this group, in order to obtain a maximum of information on the etiologic factors involved, seems to be a necessity.

"Infectious diseases" constitute the next largest group (28.6 per cent of the total cases), with ophthalmia neonatorum (10.7 per cent) and syphilis (5.3 per cent) heading the list of specified diseases. We believe that the syphilis figure is greatly understated. Probably some cases of syphilis are concealed in "congenital and hereditary" and "infectious diseases, not specified." More complete data may be obtained on this important point if ophthalmologists will cooperate by giving accurate and detailed information for every case examined.

The relation of syphilis to blindness is a subject of which all too little is known. Keyes [7] stated that a "weighted average of prevalence in the United States based on a compilation of existing material, with due emphasis given to race, social and economic status, and geographical location, would strike a figure somewhere around 5 per cent as the average prevalence of syphilis

7. Keyes, E. L.: The Present Status of Venereal Disease Prophylaxis —Social and Medical, J. Soc. Hyg. **19**: 1 (Jan.) 1933.

TABLE 4.—*Causes of Blindness: Classification by Topographic Cause*

Cause of Blindness	Number	Per Cent
Eyeball	**838**	**31.0**
Hypertension (glaucoma)	4	0.2
Refractive errors		
Myopia	93	3.4
Other refractive errors, specified	51	1.9
Refractive errors, not specified	1	0.1
Motor anomalies		
Amblyopia ex anopsia (squint)	9	0.3
Other motor anomalies, specified	—	—
Motor anomalies, not specified	—	—
Developmental anomalies and degenerative changes		
Albinism	63	2.3
Anophthalmos (excluding surgical)	9	0.3
Megalophthalmos	175	6.5
Microphthalmos	77	2.8
Aniridia	25	0.9
Disorganized eyeball	234	8.7
Other developmental and degenerative changes, specified	73	2.7
Developmental and degenerative changes, not specified	3	0.1
Panophthalmitis and endophthalmitis	21	0.8
Other disorders of eyeball, specified	—	—
Disorders of eyeball, not specified	—	—
Conjunctiva	**0**	**0.0**
Conjunctivitis	—	—
Other disorders of conjunctiva, specified	—	—
Disorders of conjunctiva, not specified	—	—
Cornea	**389**	**14.4**
Interstitial keratitis	65	2.4
Keratoconjunctivitis, phlyctenular	12	0.4
Keratitis, not specified	14	0.5
Ulcerative keratitis	277	10.3
Other disorders of cornea, specified	21	0.8
Disorders of cornea, not specified		
Iris and ciliary body	**60**	**2.2**
Iridocyclitis	53	1.9
Iritis	7	0.3
Other disorders of iris and ciliary, specified	—	—
Disorders of iris and ciliary, not specified	—	—
Crystalline lens	**461**	**17.1**
Lens opacity (cataract)	423	15.7
Dislocated lens	37	1.4
Other disorders of lens, specified	—	—
Disorders of lens, not specified	—	—
Choroid and retina	**390**	**14.4**
Choroiditis	50	1.8
Uveitis	90	3.3
Retinitis	10	0.4
Disseminated chorioretinitis	138	5.1
Detached retina	9	0.3
Retinal hemorrhage	1	0.1
Retinal degeneration	81	3.0
Obstruction of central artery or vein	—	—
Other disorders of choroid and retina, specified	11	0.4
Disorders of choroid and retina, not specified	—	—
Optic nerve	**453**	**16.7**
Optic atrophy	381	14.0
Optic neuritis	25	0.9
Neuroretinitis	41	1.5
Other disorders of optic nerve, specified	4	0.2
Disorders of optic nerve, not specified	2	0.1
Vitreous humor	**6**	**0.3**
Intra-ocular hemorrhage	2	0.1
Opacities	3	0.1
Other disorders of vitreous humor, specified	1	0.1
Miscellaneous and ill defined	**105**	**3.9**
Amblyopia, undefined	41	1.5
Other ill defined lesions, specified		
Lesions, not specified	64	2.4
Total—All causes	**2,702**	**100.0**

in the United States at the present time." Jeans and Cooke [8] state that the incidence of congenital syphilis among children (under 14 years) is 2 per cent. From studies of the incidence of syphilis in the general population and of syphilis in children it is our belief that, if the Wassermann test were used more as a routine and adequate treatment were given to syphilitic persons, much unnecessary blindness could be prevented.

That blindness still results from ophthalmia neonatorum is deplorable. Although silver nitrate is apparently an excellent preventive, the problem of prevention should go further back than this. The proper preparation of the birth canal should receive greater consideration and the treatment of gonorrhea [9] in clinics must be improved. Education in regard to prevention of gonorrhea and the universal use of prophylactic stations are other factors of great importance.

Special mention should be made of the subdivisions appearing under ophthalmia neonatorum (table 3). Our committee wished to obtain statistics for the gonorrheal cases as differentiated from the nongonorrheal cases, but this proved to be impracticable. In the first place, the examiners reported "not specified" in seven of every ten cases, and, from the fact that some examiners reported all their cases as gonorrheal, it is possible that their figures represent their opinion that only the gonorrheal type leads to blindness. Definite information on some of the cases might be obtained by referring to hospital and board of health records.

"Traumatic and chemical injuries" rank third on the list of etiologic causes (7.8 per cent of the total cases). Perhaps the percentage was so small because of the fact that, when the ophthalmologist could not determine the etiology in cases of enucleation and the like, he preferred to classify them as "unspecified" rather than to accept the parent's claim of accident.

"Neoplasms" (2.2 per cent), "noninfectious systemic diseases" (1.2 per cent) and "toxic poisoning" (0.1 per cent) are together responsible for only a small proportion of the total cases. This small percentage is due to the fact that only the younger age groups were included in the results. It should be mentioned also

8. Jeans, P. C., and Cooke, J. V.: Prepubescent Syphilis, New York, D. Appleton & Co., 1930, p. 94.

9. Goldberg, J. A.: Personal communication to the authors, March 26, 1935.

that in 9 per cent of the total cases etiology was "not specified." More intensive investigation into available records would reduce the number of these cases, but this group should be eliminated finally by more adequate primary recording.

Topographic Classification.—For the topographic classification (table 4) the parts of the eye have been used as the eight main headings: (1) eyeball, (2) conjunctiva, (3) cornea, (4) iris and ciliary body, (5) crystalline lens, (6) choroid and retina, (7) optic nerve and (8) vitreous humor. Separate headings are available for types of disorders of the eye occurring frequently enough to warrant them, and at the end of each group have been inserted the items "other affections specified" and "affections . . . not specified."

Disorders involving the entire eyeball constitute the largest group of topographic causes (31 per cent). These are largely the developmental anomalies; e. g., megalophthalmos, microphthalmos, albinism, and the refractive errors. An analysis of this group by etiologic factor indicates that seven of ten of the disorders of the eyeball are "congenital and hereditary" cases; the remainder were due chiefly to "infectious diseases" and to "traumatic and chemical injuries."

Disorders of the lens (cataract 15.7 per cent and dislocated lens 1.4 per cent) comprise the next largest group. These also are almost entirely included in the "congenital and hereditary" group. Only primary cataracts were considered congenital. However, it is possible that some of the cataracts diagnosed as primary are really secondary to uveitis and other inflammatory conditions but could not be so diagnosed because of the lapse of time between the onset of the condition and the examination. This study of the ophthalmologist's recommendations and prognosis indicates that operations for cataract as well as for other conditions have not been carried out in many cases. Even when the visual acuity obtained is disappointing (as it sometimes is in spite of apparently good surgical results), it must be remembered that the smallest improvement in vision is of great value to these blind children. Many of the schools, however, have neither the facilities for surgery and treatments nor adequate procedure to bring the physician's recommendations to the attention of welfare agencies that can arrange for the neces-

sary service. In some cases ophthalmologists are undertaking the corrective work voluntarily, although they are handicapped by lack of funds for providing necessary lenses and also by the lack of proper personnel to do follow-up work in the homes. This is another function which the nurse or social worker could perform.

The "optic nerve" group is next in order of frequency (16.7 per cent). The etiology in these cases is divided as follows: 42 per cent "congenital and hereditary," 27 per cent "infectious diseases," principally syphilis and meningitis, 9 per cent "neoplasms," 5 per cent "traumatic and chemical injuries," 2 per cent "noninfectious systemic diseases," and the remainder not specified. It is probable that some of the cases reported as "optic atrophy" represent the terminal stage of some other eye diseases and should be classified under other headings.

Among the causes affecting the cornea, which include 14.4 per cent of the total cases, ulcerative keratitis appears most often. About two thirds of these cases are due to ophthalmia neonatorum. Interstitial keratitis, amounting to 2.4 per cent of the total cases, is described in most cases as syphilitic in origin.

Diseases of the choroid and retina account for 14.4 per cent of the cases; one third of these were only indefinitely classified as to etiology. They were ascribed to "infectious diseases, not specified" or to "undetermined by physician." The Wassermann reaction is a fairly accurate guide in syphilis, but available tests for the diagnosis of other infections have much less diagnostic importance. This is the reason why focal infection is ignored in one country and tuberculosis is considered the commonest cause of chronic infections, whereas in other countries the emphasis is reversed. Neither opinion has much scientific, bacteriologic or pathologic foundation. Therefore each is essentially a clinical conception. Certain serobacteriologic tests [10] and inoculation of animals may finally furnish more conclusive information.[11]

10. Berens, Conrad; Connolly, P. T., and Chapman, G. H.: Focal Infection in Diseases of the Eye: I. Report of Certain Laboratory Examinations, Tr. Internat. Cong. Ophth., Madrid **1**: 247, 1933.

11. Rosenow, E. C., and Nickell, A. C.: Elective Localization in Determining the Etiology of Chronic Uveitis, Am. J. Ophth. **15**: 1 (Jan.) 1932. Brown, A. L.: Chronic Uveitis: Bacteriologic and Immunologic Considerations, Tr. Sect. Ophth., A. M. A., 1934, p. 111.

Another third were classified as "congenital and hereditary" and the remainder were due principally to specified infectious diseases and trauma. The other groups are not large enough to call for special analysis.

From this analysis it is evident that the assembling of sound and consistent statistical information on the causes of blindness in children may have considerable significance in shaping a program of preventive ophthalmology, in illustrating the effectiveness of preventive methods used, and for teaching purposes.

CONCLUSIONS

1. More ophthalmologic service is required for children in schools for the blind if much blindness is to be prevented and many children are to be removed from the blind group and placed in the seeing and partially seeing classifications. This service should include provision for corrective operations and treatment as well as for examinations. It is important to remember that a large proportion of this group are wards of the state and that, once removed from their home communities, they are usually out of reach of medical service other than the facilities which the institution provides. If improved eye service were available, more accurate etiologic information could be obtained for classifying the cases, on which effective work for the prevention of blindness must be based.

2. If blindness is to be prevented, it seems desirable to make available to the schools the services of a public health nurse or medical social worker with a good knowledge of eye conditions, to supplement the work of the physician. Such a worker could make contacts with parents to obtain their cooperation in necessary treatments; for example, operations and antisyphilitic treatments. She would be in a position also to do preventive work in the homes in which syphilis or hereditary factors are problems.

3. Although ophthalmia neonatorum accounts for only 10.7 per cent of the blindness in the group studied, continued effort should be made to reduce the number of cases of blindness and visual defects arising from this disease. Until a drug has been proved more effective than silver nitrate, its use as a prophylactic should be required. If blindness from this preventable disease is to be decreased, education must be continued in

regard to the proper care of the birth canal, the need for improvement in the treatment of gonorrhea in clinics, and the use of prophylactic stations. More careful bacteriologic technic and complete records are needed before the rôle of the gonococcus, as compared with other bacteria in the cause of ophthalmia neonatorum, can be properly evaluated and adequate preventive measures instituted.

4. Since the hereditary and congenital group apparently accounts for more than 50 per cent of the blindness in these schools for the blind, and since some of this is undoubtedly due to syphilis, it is imperative that the methods of preventing syphilis be improved. More accurate knowledge of the etiologic factors underlying these ocular defects need to be secured before adequate preventive measures can be successfully applied. It seems evident that syphilis plays a larger part in the etiology of these conditions than these statistics indicate.

5. Because syphilis heads the list of specified diseases and accounts for 5.3 per cent of blindness in these schools for the blind and is probably also responsible for a large proportion of blindness now classified as "congenital" or "hereditary," better methods of preventing and treating syphilis must be insisted on. The antepartum care of syphilitic mothers, better treatment of syphilitic diseases in syphilis clinics, eye clinics and hospitals, and better organized social service and follow-up work will aid greatly in reducing the number of children who may become blind from this cause. In addition to searching for eye diseases attributable to syphilis and preventing blindness as a result of this disease, every ophthalmologist should work for a comprehensive plan in each state for the prevention and treatment of syphilis and the education of the public regarding this disease.

6. Diseases of the choroid and retina are responsible for the visual impairment of 14.4 per cent of the children in these schools for the blind. This group includes disseminated chorioretinitis, choroiditis, uveitis and several other conditions that could be classified only indefinitely as to etiology. Excluding the traumatic cases and those due to known infections, it is evident that this group will require much fundamental research before the etiology can be stated specifically and blindness prevented by direct attack on the underlying

cause. The Wassermann reaction is a fairly accurate guide in syphilis, but no equally valuable tests are available in the study of tuberculosis and focal infections.

7. Although the percentage of blindness (7.8) attributable to traumatic and chemical injuries is comparatively small among the children studied, the presence of this cause indicates that educational efforts and the improvement of safety devices should be continued.

8. Because the visual acuity in this group was better than 20/200 in 12.6 per cent of the pupils and was above 20/70 in nearly 4 per cent, ophthalmologists should insist that more attention be paid to educational opportunities. Sight-saving classes should be available for children whose visual defects are not serious enough to justify education by tactual methods but who cannot be safely or profitably educated in the regular public school classes.

These statistics on the causes of blindness in schools for the blind in the United States are probably better than those obtained previously. However, this study clearly indicates the need for the cooperation of ophthalmologists and all concerned with eye diseases and blindness in obtaining more reliable statistical information, especially in regard to exact etiology. We believe that members of the Section on Ophthalmology of the American Medical Association will continue to cooperate as they have in the past.

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